

What is claimed is:

- 1           1.     A control station for two-way satellite communication,  
2 comprising:  
3           an RF section for transmitting a broadcast signal and receiving a  
4 return channel uplink;  
5           a plurality of burst channel demodulators for demodulating the  
6 return channel uplink;  
7           a timing section including a delay receiver, an echo timing receiver,  
8 and a timing processor receiving outputs from the delay receiver and the  
9 echo timing receiver;  
10          a frame pulse generator coupled to the plurality of burst channel  
11 demodulators and the timing section,  
12          wherein the frame pulse generator provides a superframe marker  
13 pulse to the timing section at a first fixed time interval and concurrently  
14 provides a superframe header which is included in the broadcast signal,  
15          wherein the frame pulse generator pulses the plurality of burst  
16 channel demodulators at a second fixed time interval different from the  
17 first fixed time interval and at a time later than a time of the superframe  
18 marker pulse by a space timing offset interval.
- 1           2.     The control station of claim 1, wherein the space timing offset  
2 interval is approximately equal to a maximum round-trip time from a  
3 furthest receiver plus two frame duration intervals.
- 1           3.     The control station of claim 1, wherein the first fixed time  
2 interval is equal to an integral number of frame duration intervals.
- 1           4.     The control station of claim 3, wherein the integral number of  
2 frame duration intervals is equal to eight.

1           5.     The control station of claim 1, wherein the second fixed time  
2 interval is approximately 45 msec.

1           6.     The control station of claim 1, wherein a frame duration time  
2 interval is approximately equal to the second fixed time interval.

1           7.     The control station of claim 6, wherein the frame duration  
2 time interval is approximately 45 msec.

1           8.     The control station of claim 1, wherein the broadcast signal is  
2 an asynchronous DVB transport stream.

1           9.     The control station of claim 1, wherein the return channel  
2 uplink is a TDMA signal.

1           10.    A transceiver for transmitting a frame synchronized message,  
2 comprising:

3               a receiver which detects a frame reference marker and a control  
4 node timing message in a received broadcast signal;

5               a local clock adapted to tag the detected frame reference marker  
6 with a local reception time;

7               a timing recovery section which uses the control node timing  
8 message to determine a transmit frame start time; and

9               a transmitter adapted to uplink a message during an assigned  
10 period after the transmit frame start time.

1           11.    The transceiver of claim 10, wherein the timing recovery  
2 section uses the local reception time and a local offset time to determine  
3 the transmit frame start time.

1           12. The transceiver of claim 10, wherein the timing recovery  
2 section compensates for a satellite drift.

1           13. The transceiver of claim 10, wherein the control node timing  
2 message provides timing information for a previously transmitted frame  
3 reference marker.

1           14. The transceiver of claim 10, wherein the timing recovery  
2 section is adapted to correct for a space timing offset.

1           15. The transceiver of claim 10, wherein the timing recovery  
2 section is adapted to derive a symbol timing reference using a receiver bit  
3 arrival rate.

1           16. The transceiver of claim 10, wherein the transmitter is  
2 adapted and controlled to transmit within a TDMA frame in accordance  
3 with a time-slot allocation scheme.

1           17. A method for providing communication timing information  
2 from a control station, comprising:  
3       generating a timing marker;  
4       determining a control station timing delay; and  
5       providing the timing marker and the control station timing delay in  
6 a message received by a remote user.

1           18. The method of claim 17, wherein the timing marker is a  
2 superframe marker.

1           19. The method of claim 18, wherein the superframe marker is  
2 provided to a timing section of the control station.

20. The method of claim 17, wherein the message received by the remote user includes a time delay associated with a satellite drift.

21. The method of claim 17, wherein the control station timing delay corresponds to a previous timing marker provided in a prior message to the remote user.

22. The method of claim 18, wherein the superframe marker is periodically provided in messages to the remote user at a first fixed interval.

23. The method of claim 17, further comprising providing an inroute channel message to an inroute receiver.

24. The method of claim 22, further comprising pulsing an inroute receiver at a time later than a time of the superframe marker pulse by a space timing offset interval.

25. The method of claim 24, wherein the space timing offset interval is approximately equal to a maximum round-trip time from a furthest remote user plus two frame duration intervals.

26. The method of claim 17, wherein the message to the remote user is broadcast on an asynchronous DVB transport stream.

27. A method for transmitting a frame synchronized message, comprising:  
receiving a frame reference marker in a local receiver of one of a plurality of distributed user nodes;

5 timestamping the received frame reference marker with a local  
6 reception time;  
7 receiving a control node timing differential at the local receiver;  
8 correcting the local reception time by applying the control node  
9 timing differential and a local offset time;  
10 determining a start time for a return channel frame using the  
11 corrected local reception time; and  
12 transmitting a first message from one of the plurality of distributed  
13 user nodes during an assigned period within the return channel frame.

1 28. The method of claim 27, wherein correcting the local  
2 reception time includes applying a satellite drift correction.

1 29. The method of claim 27, wherein the control node timing  
2 differential is received after the received frame reference marker is  
3 timestamped with the local reception time.

1 30. The method of claim 27, further comprising locally deriving a  
2 system symbol timing reference using a bit arrival rate in the local  
3 receiver.

1 31. The method of claim 27, further comprising centrally  
2 receiving a plurality of different user messages, wherein each of the  
3 plurality of different user messages is transmitted within the return  
4 channel frame in accordance with a time-slot allocation scheme.

1 32. The method of claim 27, further comprising transmitting a  
2 second message from a different one of the plurality of distributed user  
3 nodes during a different assigned period within the return channel frame  
4 in accordance with a time-slot allocation scheme, wherein the different

- 5 one of the plurality of distributed user nodes uses the frame reference  
6 marker to determine the different assigned period.

1 33. A communication system for sharing return channel uplink  
2 timing information, comprising:  
3 a common symbol timing reference;  
4 a first control station transmitting a first broadcast data stream in  
5 accordance with the common symbol timing reference,  
6 said first control station including a first delay tracker to determine  
7 a first transmission delay associated with the first control station;  
8 said first broadcast data stream including a non-real time frame  
9 marker and a first transmission delay message;  
10 a first receiver to receive the first broadcast data stream,  
11 said first receiver receiving the first delay message and  
12 timestamping the non-real time frame marker with a first local time of  
13 receipt;  
14 a first timing recovery circuit to determine an upcoming real-time  
15 return channel frame start time by adjusting the first local time of receipt  
16 by the first transmission delay and a first receiver offset time; and  
17 a first local transmitter to uplink a message in a predetermined  
18 time-slot after the real-time return channel frame start time.

1 34. The communication system of claim 33, further comprising:  
2 a second control station transmitting a second broadcast data  
3 stream in accordance with the common symbol timing reference,  
4 said second control station including a second delay tracker to  
5 determine a second transmission delay associated with the second control  
6 station;  
7 said second broadcast data stream including non-real time frame  
8 marker and a second delay message;

9 a second receiver to receive the second broadcast data stream,  
10 said second receiver receiving the second delay message and  
11 timestamping the non-real time frame marker with a second local time of  
12 receipt;  
13 a second timing recovery circuit to determine real-time return  
14 channel frame start time by adjusting the second local time of receipt by  
15 the second transmission delay and a second receiver offset time; and  
16 a second local transmitter to uplink a second user message in a  
17 different predetermined time-slot after the real-time return channel frame  
18 start time.

1 35. The communication system of claim 33, wherein said first  
2 broadcast data stream is an asynchronous DVB transport stream.

1 36. The communication system of claim 33, wherein said first  
2 broadcast data stream is encapsulated in an IP/DVB protocol layer.

1 37. The communication system of claim 33, further comprising a  
2 communication satellite to relay the transmitted first broadcast data  
3 stream to the first receiver.

1 38. A method for sharing a set of TDMA channels between a  
2 plurality of uplink channels, comprising:  
3 providing a non-real time system reference timing message to a  
4 remote user;  
5 calculating a message transport delay;  
6 offsetting a local time reference from the non-real time system  
7 timing by the message transport delay;  
8 determining a realtime TDMA transmit frame timing from the offset  
9 local time reference; and

10 transmitting uplink channel information in accordance with the  
11 realtime TDMA transmit frame timing and a TDMA time-sharing  
12 arrangement.

1 39. The method of claim 38, further comprising receiving a frame  
2 marker message encapsulated in a layered transport stream.

1 40. The method of claim 39, wherein said layered transport  
2 stream is an asynchronous DVB transport stream.

1 41. The method of claim 38, wherein the non-real time system  
2 timing message is provided to a plurality of remote users.

1 42. The method of claim 38, wherein the non-real time system  
2 reference timing message is provided to a plurality of remote users over  
3 more than one layered transport stream.